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CHARACTERIZING CROSS-COUNTRY CONSUMPTION CORRELATIONS

ABSTRACT

General equilibrium models of international fluctuations which assume complete asset markets predict that consumption will be highly correlated across countries, while the data display correlations which are rather low. It is common to characterize this empirical regularity by noting that cross-country consumption correlations tend to be lower than corresponding output correlations. This paper reconsiders that characterization and demonstrates that it is not particularly robust. The paper also documents a related regularity that is more pervasive: Consumption fluctuations are more highly correlated with domestic production than with world output. Implications for the evaluation of theoretical models are discussed.

KEYWORDS: Asset Markets, Consumption Correlations, International Business Cycles, Nontraded Goods, Risk Pooling

JEL CLASSIFICATION: F41, F15, G15

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1. Introduction

An emerging branch of research in the field of open-economy macroeconomics seeks to describe the co-movements and transmission of economic fluctuations across countries in the context of dynamic general equilibrium models. Examples of this research include Cantor and Mark (1988), Stockman and Tesar (1990), Devereux, Gregory and Smith (1992), Backus, Kehoe and Kydland (1992, 1993), Baxter and Crucini (1993) and Tesar (1993), among others. As with any theoretical model-building, these efforts require researchers to strike a balance between realism and tractability: That is, the structure of the model must incorporate the relevant features of the phenomena to be explained, but it must also be a simplified abstraction to allow meaningful analysis.

One of the assumptions often made in these models of international fluctuations is that world financial markets are complete, in the sense that individuals in different countries are able to hedge their specific consumption risks through international portfolio diversification. As a literal representation, this assumption appears to be at odds with reality along several dimensions.

A particular feature which has been a focus of attention is the correlation of consumption fluctuations across countries. If individuals in different countries are able to trade assets in order to diversify risk and smooth consumption, as these models assume, theory suggests that consumption movements should be highly correlated across countries. In fact, the data suggest that cross-country consumption correlations are rather low, tending to be even lower than the corresponding output correlations. Backus, Kehoe and Kydland (1992) have called this piece of evidence "the most striking discrepancy" . . . "between theory and data." Some have cited this apparent contradiction as indicating that asset market incompleteness might be a necessary feature of models seeking to explain the dynamics of international fluctuations.[1]

This paper considers some of the existing evidence on cross-country consumption correlations, and presents additional findings. Using time series drawn from two sets of international data, I demonstrate that the particular ranking of consumption and output correlations often cited in the literature (that consumption correlations are lower than output correlations) is not particularly robust with respect to country coverage, data definitions and frequency. Although this characterization is true for some bilateral country comparisons, it is not universal.

The results presented in this paper also document a related regularity that appears to be more robust: In the presence of complete asset markets, theory also suggests that consumption should be more highly correlated with total world production than with domestic output, while the data show the opposite. This characterization of the issue provides an alternative standard for economists seeking to construct models that are consistent with broadly observed patterns of international fluctuations.

The layout of the paper is as follows. The first section describes a simple model that demonstrates why the complete-markets assumption implies both high cross-country consumption correlations and high correlations between an individual country's consumption and total world output. The next section reviews and

[1]See, for example, Kollmann (1990), and Baxter and Crucini (1992).

extends the evidence on cross-country consumption and output correlations, demonstrating that although the observation of "low" consumption correlations across countries is robust to changes in definitions, data frequency and detrending methods, the specific finding that consumption correlations are lower than output correlations is not universal. Some implications for the evaluation of theoretical models are then presented, followed by a brief conclusion.

2. A simple theoretical setting

In the most basic of model structures, the implications of asset market completeness for the behavior of consumption fluctuations is readily apparent. Consider a two-country model in which each country is inhabited by an infinitely-lived representative consumer. The agents receive stochastic endowments of a non-storable consumption good each period; the home country receives Y_t and the foreign country receives Y^*_t. Assume that the endowments are jointly distributed with equal unconditional variances.

Agents have preferences for consumption over time given by time separable utility functions:

$$U = \sum_{t=0}^{\infty} \beta^t u(C_t)$$

where $u(C_t)$ is a homothetic momentary utility function over aggregate consumption which has the usual properties (e.g. $u'>0$, $u''<0$), and $\beta<1$ is a time discount factor. The discount factor and the functional form of the utility function are assumed to be common to the two agents.

In the case of complete asset markets, standard welfare theorems can be invoked to find the equilibrium as the solution to a social planner's problem (given welfare weights ω and ω^*):

$$Max\ E_0\ \omega\sum_{t=0}^{\infty}\beta^t u(C_t) + \omega^*\sum_{t=0}^{\infty}\beta^t u(C_t^*) \tag{1}$$

subject to a sequence of resource constraints for each period t,

$$C_t + C_t^* = Y_t + Y_t^*. \tag{2}$$

The first-order conditions to this problem yield the fundamental relationship:

$$\frac{u'(C_t)}{u'(C_t^*)} = \frac{\omega^*}{\omega}. \tag{3}$$

With identical homothetic utility functions it is clear that equation (3)--which requires the ratio of marginal utilities to remain constant--implies that consumption will be perfectly correlated across the two countries.[2] As long as production in the two countries is less than perfectly correlated, the consumption correlation will exceed the output correlation. Of course, if the utility functions included additional arguments -- for example, leisure or non-traded goods -- then the

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[2]Equation (3) could also be derived as the solution to a decentralized asset market equilibrium, in which the ratio ω^*/ω would represent the ratio of shadow prices on the agents' intertemporal/interstate budget constraints.

consumption correlation need not be perfect.[3] The constancy of the ratio of marginal utilities would remain a necessary condition, but the direct link between marginal utility and aggregate consumption would be broken.

At the opposite extreme, suppose that no international asset trade is possible. In this case, there is no possibility for exchanging goods before the resolution of uncertainty, and no incentive to do so afterwards.[4] As a result, each country's consumption would identically equal its production. Cross-country consumption and output correlations would be equal. Generating consumption correlations which are lower than output correlations would require little additional model detail in this type of asset-market setting.

An alternative characterization of these two asset-market regimes can be described in terms of consumption-output correlations. In the case of complete asset markets, the optimal contract calls for dividing the total quantity of world output in constant proportions. Hence, each country's consumption is perfectly correlated with world output, $W_t=Y_t+Y_t^*$. The correlation of each country's consumption with its own domestic production will be less than perfect, however. Given the assumptions underlying the simple model examined in this section, this correlation can be expressed as,

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[3]Examples of models incorporating non-traded goods include Tesar (1993) and Backus and Smith (1993). Devereaux, Gregory and Smith (1992) address the role of incorporating leisure in the preference specification as a way of lowering the cross-country consumption correlation.

[4]Of course, a model with two goods could allow for exchange after the resolution of uncertainty but it would remain true that the value of production would always equal the value of consumption (at world relative prices).

$$Corr(C_t,Y_t) = \left[\frac{1}{2}(1 + Corr(Y_t,Y_t^*))\right]^{\frac{1}{2}}, \tag{4}$$

which will be lower than the (perfect) correlation of consumption with world output as long as domestic and foreign output are less than perfectly correlated.

In the absence of any asset trade, consumption is perfectly correlated with domestic production. The correlation of each country's consumption with world output will be less than one, however. In fact, the expression for $\mathrm{Corr}(C_t,W_t)$ in this case is identical to that given on the right-hand-side of equation (4). Consumption will be less than perfectly correlated with world output as long as outputs are not perfectly correlated across countries.

The particular correlations described for this simple model depend on some of the specific assumptions that have been made. More generally, though, this exercise illustrates the following points: In the absence of asset trade, we would expect to find that consumption is highly correlated with domestic production, and probably not very highly correlated with world output or with another country's consumption. When asset markets are complete, we would expect to find that consumption movements are highly correlated across countries and that each country's consumption will be more highly correlated with world output than with its own domestic production.[5]

Clearly, the assumption that markets are complete in a literal sense is unrealistic. Yet it may not be too much to expect that international financial markets are sophisticated enough that the complete-markets assumption can serve

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[5]The latter characterization was pointed out by Lucas (1982) in the context of a two-good trade model with complete asset markets.

as a useful approximation. One way to evaluate this proposition is to examine the correspondence between the implications of the complete-markets assumption and the outcomes observed in the actual world economy.

3. Evidence

3.1 Previous Studies

The empirical finding that cross-country consumption correlations tend to be lower than cross-country output correlations has been proposed as a "stylized fact" in papers by Backus, Kehoe and Kydland (1992, 1993), hereafter, BKK. Each of these studies presented correlations of various industrial countries' consumption and output with U.S. variables. Though the two papers cover different sample periods and sets of countries, both use quarterly data that had been detrended using the Hodrick-Prescott (1980) filter.[6] BKK report that correlations of U.S. consumption with foreign consumption are uniformly lower than correlations of U.S. output with foreign output.

The correlations calculated by BKK are illustrated in Figure 1, which shows consumption correlations plotted against output correlations in the form of a scatter diagram. All of the points corresponding to BKK's calculations lie below the diagonal, illustrating the relative ranking of output correlations exceeding consumption correlations.

[6] In both of the BKK, consumption data is drawn from the OECD quarterly national accounts. Nominal magnitudes are converted to real measures using GDP deflators in BKK (1992), and using a consumption deflator in BKK (1993). The earlier paper uses sample periods reflecting data availability, differing among countries; the later paper uses a uniform sample period of 1970:Q1-1990:Q2.

Figure 1 also illustrates results presented in two other papers. Again using quarterly data and the Hodrick-Prescott filter, Baxter and Crucini (1993) present correlations among eight industrial countries which generally confirm the BKK findings.[7] In only one of their bilateral correlation comparisons (Germany and the United States) is the output correlation lower than the consumption correlation.

The correlations calculated by Tesar (1993) support the consumption-output correlation ranking generally, but with several exceptions. Although the country coverage in Tesar is similar to the others, she detrends the data using first-differencing (as opposed to the Hodrick-Prescott filter).[8] In six of her 15 bilateral comparisons, the consumption correlation is higher than the output correlation.

3.2 Quarterly OECD data

In order to investigate these results further, a set of bilateral correlations were calculated using quarterly data for 15 OECD countries. The differences between Tesar's results and those of the other studies suggest that the calculations may be sensitive to the method of detrending; hence, both first-differenced and HP filtered data are examined.

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[7]The Baxter and Crucini data set ends in the mid 1980s, and all series were converted to per-capita by dividing by population. Annual population figures were log-linearly interpolated to find quarterly estimates. As in BKK (1992), Baxter and Crucini use GDP deflators to convert nominal consumption to a real measure.

[8]Tesar uses nominal consumption series reported in *International Financial Statistics*, converting the data to real terms by using consumer price indices.

Tables 1 and 2 present correlations calculated using these two detrending methods. The results are also illustrated in Figures 2 and 3. These results differ from previous studies in several respects. Most notably, the ranking of consumption correlations vs. output correlations appears to be ambiguous, a finding that is true for both detrending methods. That is, in both Figures 2 and 3 many data points lie above the 45-degree line. Notice that for correlations involving the United States (corresponding to the results presented in the BKK papers), the finding that consumption correlations are lower than output correlations generally supported by the point estimates. When bilateral comparisons among other countries are included, however, there are a number of observations for which the reverse is true.

In addition to reporting the cross-country correlations, Tables 1 and 2 present probability values for testing the significance of the difference between the correlations Corr(C,C*) and Corr(Y,Y*). These values are based on the test statistic:

$$Z = \frac{\sqrt{N-3}}{2\sqrt{2}} \left[\ln\left(\frac{1+\rho_i}{1-\rho_j}\right) - \ln\left(\frac{1+\rho_j}{1-\rho_j}\right) \right], \qquad (5)$$

where, in the current application, ρ_i=Corr(C,C*) and ρ_j=Corr(Y,Y*). Under the null of equal correlations, the statistic Z has a distribution which is approximately standard normal.[9] P-values in the lower tail represent rejections of the null hypothesis that the two correlations are equal in favor of the alternative that Corr(C,C*)<Corr(Y,Y*), while values in the upper tail represent rejection in favor

[9]See, for example, Hogg and Tannis (1983), p. 450.

of an alternative with the inequality reversed. For either filtering technique, the null hypothesis of equal correlations is rarely rejected at conventional significance levels.

Comparing the first differenced results to the HP filtered results, note that the correlations for both output and consumption tend to be higher when the latter technique is used. Moreover, consumption correlations appear more likely to exceed output correlations in the first-differenced data than the Hodrick-Prescott filtered data, suggesting that the different frequencies isolated by the two techniques matter for the characterization of co-movements.[10]

The most obvious similarity between the two cases is the generally positive correspondence between consumption and output correlations. That is, pairs of countries which have relatively high correlations of output also tend to have relatively high correlations of consumption. In Figures 2 and 3, this is reflected by the clustering of the points along the diagonal.

This observation suggests that consumption and output within countries are highly correlated, a finding which is confirmed in Table 3. Recall that the assumption of complete markets has two related implications for consumption correlations: that they should be highly correlated across countries, and that each country's consumption fluctuations should be more highly correlated with world output than with domestic output. The statistics in Table 3 clearly refute the latter hypothesis. Only for the Netherlands is consumption more highly correlated with

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[10]The properties of the Hodrick-Prescott and first-difference filters are examined in the frequency domain by King and Rebelo (1989). They illustrate that while both filters eliminate low-frequency movements, the two filters have differing effects with regard to dampening and amplifying higher-frequency fluctuations.

world output (as approximated by total OECD production) than with domestic output, and this is only true for the first-differenced data. The probability values reported in Table 3 confirm that for all other countries, the null hypothesis that $Corr(C_t,Y_t)=Corr(C_t,W_t)$ is rejected in favor of $Corr(C_t,Y_t)>Corr(C_t,W_t)$ at high levels of significance.[11]

3.3 Annual data from the Penn World Table

Further evidence on the pervasiveness of low cross-country consumption correlations can be obtained from the large international data set known as the *Penn World Tables (PWT)*.[12] Several attributes make this data set an attractive source of information about international co-movements. It covers a broad range of countries over a long sample period, it is consistently constructed for per-capita quantities and, most importantly, it expresses the data in real commodity-based terms. Using a set of benchmark comparisons covering about 150 detailed commodity categories, the PWT expresses quantities in terms of directly comparable classifications of goods.

Following the practice of previous research using the *PWT* data, only those countries that were given a data quality grade of C- or higher by Summers and Heston (1991) were analyzed. This set includes 73 countries.

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[11]For the purpose of calculating the probability values in Table 3, the Z-statistic given in equation (5) is used with $\rho_i=Corr(C_t,W_t)$ and $\rho_j=Corr(C_t,Y_t)$, so that p-values in the lower tail correspond to rejection of the null of equal correlations in favor of the alternative that $Corr(C_t,Y_t)>Corr(C_t,W_t)$.

[12]Summers and Heston (1991).

With data for 73 countries, there are far too many bilateral correlations to report in any easily digestible form. Figures 4 and 5 illustrate the pattern of bilateral consumption and output correlations for a subset of the sample consisting of the 25 member nations of the OECD (the previous subsection analyzed quarterly data for a subset of these countries).[13] For both filtering methods, the tendency for the points to lie along the diagonal is apparent, indicating the general correspondence between the magnitude of consumption and output correlations in bilateral country comparisons. There is a somewhat greater tendency for consumption correlations to lie below corresponding output correlations when first-differenced data is used, but this relationship is not at all apparent for the HP filtered data.

The bilateral correlations examined thus far may not be a particularly informative measure of consumption risk pooling, particularly for many of the smaller countries in the PWT data set. The models used by theoretical researchers usually examine a simplified model setting in which trade takes place between only two countries. Hence, the examination of a multitude of bilateral correlations does not correspond very closely with the relevant model structure. A more appropriate approach might be to compare correlations of individual country's data with corresponding aggregates representing the "rest of the world." Tables 4 and 5 report correlations calculated on this basis, and these measures are illustrated in

[13]Correlations were calculated for all 73 of the countries included in the data set. Bilateral comparisons involving non-OECD countries were broadly similar to the OECD comparisons illustrated in Figures 4 and 5, although both consumption and output correlations tend to be of somewhat smaller magnitude.

Figures 6 and 7.[14] These comparisons are broadly consistent with previously reported results. The ranking of consumption vs. output correlations is mixed, although there is a greater tendency for relatively low consumption correlations when the first-difference filter is used. The probability values reported in Tables 4 and 5 show that the null of equal correlations is rejected in favor of $\mathrm{Corr}(C,C^*)<\mathrm{Corr}(Y,Y^*)$ in a 5% one-tailed test in only two cases for the first-differenced data, and in *no* cases for the HP-filtered data. Again, the most notable feature of Figures 6 and 7 is the positive relationship between the magnitudes of consumption and output correlations.[15]

Finally, Tables 4 and 5 present the correlations of consumption with its own output and rest-of-world output. The results of these comparisons are illustrated in Figures 8 and 9. Once again, the results of this comparison are clear: Consumption fluctuations are consistently more highly correlated with domestic production than with total world output. Of the 73 countries in the sample, only the point estimates for Luxembourg violate this pattern. The hypothesis of equal

[14]World totals are defined as per-capita output and consumption totals for the 50 countries for which there is a complete set of data over the entire sample period. Correlations of the growth rates of this measure with more inclusive definitions of the world total were found to be greater than .99. Per capita rest-of-world variables are defined as the world total times world population, less the own-country measure times population, divided by rest-of-world population.

[15]Obstfeld (1994) also examines correlations between domestic and rest-of-world consumption and output growth rates using data from the *PWT*. Dividing the sample into two periods, he finds some evidence that consumption correlations have increased in recent years (at least for developed countries). He interprets this as evidence suggesting increasing international financial market integration over time.

correlations is strongly rejected in favor of Corr(C,Y)>Corr(C,W) for an overwhelming majority of the remaining countries.

4. Implications for model evaluation

Under either characterization, the stylized facts regarding consumption correlations might be considered problematic for simple complete-market models. It seems possible that a realistic model of international fluctuations will require some form of market incompleteness or friction in order to match these features of the data. Nevertheless, the value of complete-market models for evaluating international cycles can not be entirely ruled out on the basis of these data characterizations. When additional features are added to more basic models, complete markets *can* be associated with low cross-country consumption correlations and high correlations between consumption and domestic output.

The particular characterization of the data chosen does matter for model evaluation, however. When the Corr(C,C*)<Corr(Y,Y*) characterization is taken to be the relevant stylized fact, matching theory to the data has proven to be a difficult proposition. For example, models which include non-traded goods are capable of generating fairly low cross-country consumption correlations, yet realistically parameterized versions of such models, e.g. Stockman and Tesar (forthcoming), fail to generate cross-country consumption correlations which are lower than cross-country output correlations. However, the conditions required to generate higher correlations of consumption with domestic output than with foreign output are less restrictive.

To see this, consider a slight modification to the simple model described previously. Let the consumption quantity, C_t, be an aggregate of both traded and non-traded goods:

$$C_t = H(c_t^T, c_t^N) \text{ and } C_t^* = H(c_t^{T*}, c_t^{N*}) \tag{6}$$

where H(·) is assumed to be linearly homogeneous. Resource constraints on the social planner's objective function (2) are now:

$$c_t^T + c_t^{T*} = T_t + T_t^* \tag{7}$$

$$c_t^N = N_t \tag{8}$$

$$c_t^{N*} = N_t^* \tag{9}$$

where T_t (T_t^*) and N_t (N_t^*) are the home (foreign) country's output of traded and nontraded goods, respectively. First-order conditions yield a modified form for equation (3):

$$\frac{U'(C_t) h_T(c_t^T, c_t^N)}{U'(C_t^*) h_T(c_t^{T*}, c_t^{N*})} = \frac{\omega^*}{\omega}. \tag{3'}$$

When the aggregator function is separable between traded and nontraded goods, equation (3') implies that the world supply of traded goods will be allocated in constant proportions, contributing to high cross-country consumption correlations. However, aggregate consumption fluctuations across the two countries will diverge to the extent that output of nontraded goods are not perfectly correlated. The inclusion of nontraded goods will also clearly raise the correlation between aggregate consumption and aggregate output, since the nontraded components of each are perfectly correlated with each other.

Moreover, if traded goods and nontraded goods are complimentary in consumption, these divergent consumption movements will be amplified. Tesar (1993) and Feeney and Jones (1994) show that the extent to which the introduction of nontraded goods cause divergent consumption movements depends on a comparison of the elasticity of substitution between traded and non-traded goods with the intertemporal substitution elasticity.[16] In essence, if agents are more averse to changes in the composition of their consumption bundles than to changes in consumption over time, then optimal contacts will imply relatively larger and more idiosyncratic fluctuations in aggregate consumption.

Equations (7)-(9), along with equation (3') can be used to find equilibrium solutions for the consumption variables in terms of the output variables. For concreteness, assume that the aggregate utility function is of the CRRA class, with a coefficient of relative risk aversion γ,

$$U(C_t) = \frac{C_t^{1-\gamma}}{1-\gamma},$$

and that the subutility aggregator is CES,

[16]The comparison of inter-temporal and inter-good substitutability between traded and nontraded goods and its effect on international risk sharing is explored most extensively by Feeney and Jones (1994). In a model with two internationally traded goods, Pakko (1994) shows that cross-country consumption correlations can be lower than output correlations under similar elasticity conditions.

$$h(c_t^T, c_t^N) = \left[c_t^{T(1-\delta)} + c_t^{N(1-\delta)}\right]^{1/(1-\delta)},$$

where $1/\delta$ is the elasticity of substitution between traded and nontraded goods.[17] Given these functional forms, log-linearly approximated solutions for the equilibrium allocations of traded goods can be expressed as:

$$\hat{c}_t^T = \frac{1}{2}\left\{(\hat{T}_t + \hat{T}_t^*) + \left[\frac{\delta-\gamma}{\delta+\gamma}\right](\hat{N}_t - \hat{N}_t^*)\right\} \tag{10}$$

$$\hat{c}_t^{T*} = \frac{1}{2}\left\{(\hat{T}_t + \hat{T}_t^*) + \left[\frac{\delta-\gamma}{\delta+\gamma}\right](\hat{N}_t^* - \hat{N}_t)\right\} \tag{11}$$

where the circumflex (^) denotes proportionate deviations from a non-stochastic equilibrium taken to represent the trend. Equations (10) and (11) make clear the role of nontraded goods on allocations of tradeable goods, and the significance of the two elasticity parameters. When traded and nontraded goods are relatively poor substitutes (high δ relative to γ) consumption of traded goods is positively correlated with nontraded goods allocations, so that variability in the output of nontraded has amplified effects on aggregate consumption.

After aggregating consumption and production using utility-based prices, $p_t^T = h_T(\cdot)$ and $p_t^N = h_N(\cdot)$, the relevant consumption and output correlations can be constructed. Consider first a case where innovations to the output of traded and

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[17]Of course, with time-separable preferences, $1/\delta$ represents the intertemporal elasticity of substitution. Analogously, δ can be thought of as a risk aversion parameter pertaining to the risk associated with fluctuations in the composition of the consumption bundle [as discussed in Feeney and Jones (1994)]. The form of the aggregator function implies that expenditure shares on traded and nontraded goods are equal, which is broadly consistent with the shares calculated by Stockman and Tesar (forthcoming) for a sample of industrialized countries.

nontraded goods in the two countries are independently distributed with $var(T)=var(T^*)=\sigma_T^2$ and $var(N)=var(N^*)=\sigma_N^2$. Calculating correlations from the log-linearly approximated solutions and deriving conditions for the two relevant correlation comparisons yields:

$$Corr(C,C^*)<Corr(Y,Y^*) \text{ if } \sigma_T^2 < \eta(2+\eta)\sigma_N^2$$

$$Corr(C,Y)>Corr(C,W) \text{ if } \frac{\sigma_T^2 + \sigma_N^2}{\sigma_T^2 + (2+\eta)\sigma_N^2} < \frac{\sqrt{2}}{2}$$

These two regions of the parameter space are illustrated in Figure 10 as the areas lying beneath the two loci defining equal correlations. It is clear from Figure 10 that the latter condition is satisfied for a wider range of parameter values than is the former.

But are the feasible parameter values associated with Corr(C,Y)>Corr(C,W) plausible? To investigate this question, correlations were calculated for a more general variance-covariance matrix for the output fluctuations, calibrated using second moments estimated by Stockman and Tesar (forthcoming).[18] These correlations are reported in Table 6. The upper panel of Table 6 displays correlations for various values of δ, given a logarithmic specification for u(·). The lower panel shows varies γ, holding the elasticity of substitution between traded and non-traded goods equal to Stockman and Tesar's computed value of .44. In

[18]In particular, Stockman and Tesar's calculations imply cov(T,T*)=6.701, cov(N,N*)=2.383, cov(T,N)=4.878, var(T)=11.903, and var(N)=4.080. Assuming a symmetric variance-covariance matrix, the remaining elements of the matrix are set with cov(T,N*)=cov(T*,N)=3.70 so as to approximately match var(Y)=6.4 and corr(Y,Y*)=.64.

none of the cases considered is Corr(C,C*)<Corr(Y,Y*), yet there are several combinations of γ and δ for which Corr(C,Y)>Corr(C,W).

5. Conclusions

The correlations examined in this article, drawn from two sets of international data, suggest little evidence to support the notion that individuals in different countries use international financial markets to pool aggregate consumption risk in the way that simple theoretical models suggest. For instance, the finding that correlations between consumption and domestic output are higher than correlations between consumption and world output is nearly universal. However, the characterization of this finding articulated in other studies -- emphasizing the relative magnitudes of cross-country consumption and output correlations -- is not robust.

Nevertheless, the evidence presented here does not necessarily reject the hypothesis that international financial markets are important in the determination of cross-country dynamics.[19] Models which include non-traded goods, for example, are capable of generating consumption correlations which are consistent with the data when literally complete asset markets are assumed. The results reported in this article suggest that models should not be dismissed simply because they fail to generate consumption correlations which are lower than output correlations. It does appear, however, that models which seek to explain international co-

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[19]This is not to say that financial market restrictions do not matter. For example, Lewis (1993) finds that countries in the PWT data set which had imposed capital restrictions exhibited a significantly lower tending for consumption risk-sharing than did those which did not impose restrictions.

movements should address the issue of the high correlations between fluctuations of consumption and output within countries.

Appendix: Data sources and definitions

(a) Quarterly data: All quarterly data was taken from the OECD quarterly national account tape. Variables used for each country were real private consumption expenditures (RPFCE) and real gross domestic product (RGDP). In cases where seasonally adjusted data were not available (Austria, Finland, Norway and Portugal), the X-11 procedure was applied to remove seasonal movements. The terminal data for the sample period was 1993Q4 (except for the Portuguese data, which ended in 1993Q3). Starting dates for the data are as follows: Canada, Japan, U.K. and U.S., 1955Q1; Australia 1959Q3; OECD Total 1960Q1; Norway 1966Q1; West Germany 1968Q1; France, Italy, Spain, Switzerland and Japan 1970Q1; Finland 1975Q; Portugal and the Netherlands 1977Q1.

(b) Annual data: All annual data used are from Version 5.5 of the Penn World Tables. Version 5, which included data through 1988, is described in Summers and Heston (1991). The updated data set includes observations through 1990. The variables used were Real GDP per capita in constant dollars using chain interpolation (RGDPCH), Consumption share of GDP (C), and population (P).

REFERENCES

Backus, David K., Patrick J. Kehoe and Finn E. Kydland. "International Real Business Cycles," *Journal of Political Economy* (August 1992), pp. 745-75.

Backus, David K., Patrick J. Kehoe and Finn E. Kydland. "International Business Cycles: Theory vs. Evidence," Federal Reserve Bank of Minneapolis *Quarterly Review* (Fall 1993), pp. 14-29.

Backus, David K., and Gregor W. Smith. "Consumption and Real Exchange Rates in Dynamic Economies with Non-Traded Goods," *Journal of International Economics* (November 1993), pp. 297-316.

Baxter, Marianne and Mario J. Crucini. "Business Cycles and the Asset Structure of Foreign Trade," Institute for Empirical Macroeconomics Discussion Paper 59, Federal Reserve Bank of Minneapolis and University of Minnesota (March 1992).

Baxter, Marianne and Mario J. Crucini. "Explaining Savings-Investment Correlations," *The American Economic Review* (June 1993), pp. 416-36.

Cantor, Richard and Nelson C. Mark. "The International Transmission of Real Business Cycles," *International Economic Review* (August 1988), pp. 493-507.

Devereux, Michael B., Allan W. Gregory, and Gregor W. Smith. "Realistic Cross-Country Consumption Correlations in a Two-Country, Equilibrium, Business Cycle Model," *Journal of International Money and Finance* (February 1992), pp. 3-16.

Hodrick, Robert J., and Edward C. Prescott. "Post-War U.S. Business Cycles: An Empirical Investigation," Manuscript, Carnegie Mellon University (1980).

Hogg, Robert V., and Elliott A. Tannis. *Probability and Statistical Inference*, 2nd edition, New York: MacMillan (1983).

King, Robert G., and Sergio T. Rebelo. "Low Frequency Filtering and Real Business Cycles," Rochester Center for Economic Research, Working Paper 205 (October 1989).

Kollmann, Robert. "World Business Cycles and Incomplete International Asset Markets," Manuscript, University of Chicago (1990).

Lewis, Karen K. "What can Explain the Apparent Lack of International Consumption Risk Sharing?" Manuscript, University of Pennsylvania (July 1993).

Lucas, Robert E. "Interest Rates and Currency Prices in a Two-Country World" *Journal of Monetary Economics* 10 (1982), 335-359.

Obstfeld, Maurice. "International Capital Mobility in the 1990s," International Finance Discussion Paper Number 472, Board of Governors of the Federal Reserve System (June 1994).

Pakko, Michael R. "Reconciling Low Cross-Country Consumption Correlations with International Risk Sharing," Working Paper 94-019, Federal Reserve Bank of St. Louis.

Stockman, Alan C. and Linda L. Tesar. "Tastes and Technology in a Two-Country Model of the Business Cycle: Explaining International Comovements," National Bureau of Economic Research Working Paper No. 3566 and *The American Economic Review* (forthcoming).

Summers, Robert and Alan Heston. "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988," *The Quarterly Journal of Economics* (May 1991), pp. 327-68.

Tesar, Linda L. "International Risk-Sharing and Non-Traded Goods," *Journal of International Economics* (August 1993), 69-89.

Table 1:
Cross-Country Correlations -- First Differenced Data

Panel A: Consumption

	S.D. (%)	Australia	Austria	Canada	Finland	France	Germany	Italy	Japan	Netherlands	Norway	Portugal	Spain	Switzerland	U.K.	U.S.
Australia	0.85	1.00														
Austria	1.76	0.11	1.00													
Canada	1.07	0.31	0.19	1.00												
Finland	1.21	0.15	-0.22	0.08	1.00											
France	0.75	0.23	0.11	0.24	0.30	1.00										
Germany	0.83	0.08	0.22	0.18	0.06	0.42	1.00									
Italy	0.66	0.06	0.15	0.23	0.24	0.25	0.29	1.00								
Japan	1.38	0.10	-0.04	0.09	0.35	0.29	0.25	0.17	1.00							
Netherlands	1.03	0.17	0.16	-0.00	-0.03	0.33	0.48	0.19	0.06	1.00						
Norway	2.14	0.13	0.15	0.29	-0.02	0.39	0.26	0.12	-0.05	0.22	1.00					
Portugal	0.88	-0.06	0.13	-0.15	-0.01	0.08	0.18	0.18	0.09	-0.11	-0.03	1.00				
Spain	0.86	0.14	0.23	0.32	0.17	0.27	0.28	0.44	0.21	0.14	0.02	0.35	1.00			
Switzerland	0.78	0.12	0.18	0.29	0.23	0.31	0.33	0.32	0.12	0.22	0.13	0.08	0.28	1.00		
U.K.	1.21	0.11	0.04	0.11	0.42	0.20	0.27	0.09	0.13	0.10	0.10	0.10	0.14	0.24	1.00	
U.S.	0.69	0.12	0.03	0.35	0.08	0.25	0.21	0.04	0.27	-0.00	0.15	-0.28	0.10	0.11	0.16	1.00
OECD Total	0.51	0.26	0.15	0.42	0.30	0.54	0.56	0.32	0.62	0.23	0.19	-0.07	0.37	0.33	0.42	0.78

Panel B: Output

	S.D. (%)	Australia	Austria	Canada	Finland	France	Germany	Italy	Japan	Netherlands	Norway	Portugal	Spain	Switzerland	U.K.	U.S.
Australia	1.47	1.00														
Austria	1.08	-0.05	1.00													
Canada	1.06	0.26	0.05	1.00												
Finland	1.57	0.24	0.10	0.05	1.00											
France	0.63	0.05	0.49	0.22	0.35	1.00										
Germany	0.87	0.13	0.44	0.15	0.11	0.63	1.00									
Italy	0.92	-0.04	0.35	0.18	0.10	0.57	0.41	1.00								
Japan	1.32	0.10	0.12	0.28	0.15	0.34	0.33	0.16	1.00							
Netherlands	1.52	-0.17	0.10	0.16	0.00	0.29	0.42	0.22	0.21	1.00						
Norway	2.21	0.07	0.10	0.11	0.05	0.17	0.30	0.14	-0.01	0.38	1.00					
Portugal	1.50	0.10	0.24	0.01	-0.02	0.17	0.09	0.18	0.35	0.06	0.00	1.00				
Spain	0.63	0.06	0.36	0.28	0.18	0.54	0.34	0.41	0.27	0.17	0.00	0.19	1.00			
Switzerland	0.90	0.05	0.40	0.20	0.45	0.40	0.34	0.49	0.05	0.08	0.07	0.15	0.43	1.00		
U.K.	1.11	0.17	0.05	0.15	0.25	0.34	0.32	0.10	0.24	0.39	0.07	0.07	0.25	0.05	1.00	
U.S.	0.93	0.20	0.08	0.48	0.03	0.20	0.30	0.20	0.18	0.23	0.20	-0.16	0.16	0.16	0.21	1.00
OECD Total	0.61	0.24	0.27	0.54	0.19	0.56	0.61	0.44	0.57	0.45	0.20	0.07	0.41	0.32	0.49	0.79

Panel C: P-Values for testing Corr(C,C*) = Corr(Y,Y*)

	S.D. (%)	Australia	Austria	Canada	Finland	France	Germany	Italy	Japan	Netherlands	Norway	Portugal	Spain	Switzerland	U.K.	U.S.
Australia																
Austria		0.894														
Canada		0.652	0.864													
Finland		0.278	0.026	0.576												
France		0.887	0.002	0.554	0.370											
Germany		0.359	0.035	0.600	0.385	0.023										
Italy		0.740	0.067	0.620	0.810	0.003	0.174									
Japan		0.505	0.111	0.037	0.900	0.366	0.271	0.548								
Netherlands		0.974	0.632	0.181	0.428	0.601	0.657	0.429	0.194							
Norway		0.668	0.643	0.915	0.326	0.953	0.388	0.454	0.394	0.158						
Portugal		0.198	0.258	0.187	0.532	0.314	0.698	0.509	0.065	0.172	0.417					
Spain		0.707	0.152	0.614	0.483	0.012	0.337	0.600	0.331	0.445	0.564	0.835				
Switzerland		0.684	0.053	0.738	0.067	0.236	0.480	0.095	0.664	0.794	0.658	0.341	0.121			
U.K.		0.324	0.455	0.385	0.877	0.153	0.348	0.459	0.164	0.041	0.583	0.558	0.221	0.903		
U.S.		0.262	0.355	0.081	0.628	0.638	0.256	0.143	0.784	0.093	0.372	0.228	0.350	0.369	0.324	
OECD Total		0.557	0.163	0.100	0.759	0.413	0.287	0.175	0.741	0.082	0.449	0.224	0.349	0.537	0.231	0.369

Table 2:
Cross-Country Correlations -- HP Filtered Data

Panel A: Consumption

	S.D. (%)	Australia	Austria	Canada	Finland	France	Germany	Italy	Japan	Netherlands	Norway	Portugal	Spain	Switzerland	U.K.	U.S.
Australia	1.10	1.00														
Austria	1.45	-0.09	1.00													
Canada	1.42	0.28	0.20	1.00												
Finland	1.79	0.36	0.10	0.22	1.00											
France	0.89	0.07	0.28	0.23	0.44	1.00										
Germany	1.33	-0.29	0.20	0.02	0.11	0.37	1.00									
Italy	1.39	0.19	0.23	0.25	0.40	0.35	0.40	1.00								
Japan	1.36	0.03	0.10	0.01	0.58	0.52	0.36	0.40	1.00							
Netherlands	1.37	-0.05	0.10	0.21	0.24	0.27	0.75	0.47	0.48	1.00						
Norway	2.32	-0.13	-0.02	0.17	-0.41	0.05	0.14	-0.12	-0.26	0.09	1.00					
Portugal	1.72	0.04	0.05	-0.08	0.26	0.41	0.01	0.48	-0.04	-0.25	-0.13	1.00				
Spain	1.33	0.20	0.36	0.38	0.55	0.46	0.25	0.68	0.41	0.34	-0.17	0.46	1.00			
Switzerland	1.38	-0.05	0.41	0.31	0.14	0.48	0.42	0.46	0.40	0.51	-0.06	0.22	0.39	1.00		
U.K.	1.74	0.16	0.19	0.34	0.55	0.46	0.19	0.31	0.44	0.39	-0.24	0.07	0.33	0.49	1.00	
U.S.	1.19	-0.04	0.18	0.58	-0.05	0.37	0.26	-0.04	0.26	0.22	0.19	-0.53	0.10	0.35	0.44	1.00
OECD Total	0.82	0.05	0.27	0.54	0.28	0.61	0.52	0.34	0.57	0.54	0.06	-0.24	0.40	0.55	0.66	0.86

Panel B: Output

	S.D. (%)	Australia	Austria	Canada	Finland	France	Germany	Italy	Japan	Netherlands	Norway	Portugal	Spain	Switzerland	U.K.	U.S.
Australia	1.67	1.00														
Austria	1.23	0.07	1.00													
Canada	1.58	0.51	0.15	1.00												
Finland	2.30	0.42	0.24	0.23	1.00											
France	1.05	0.15	0.68	0.25	0.43	1.00										
Germany	1.53	0.13	0.72	0.17	-0.02	0.60	1.00									
Italy	1.61	0.32	0.63	0.41	0.30	0.66	0.59	1.00								
Japan	1.59	0.11	0.39	0.02	0.20	0.51	0.72	0.39	1.00							
Netherlands	1.55	0.16	0.51	0.31	0.24	0.37	0.70	0.57	0.52	1.00						
Norway	1.86	0.09	-0.01	0.23	-0.20	-0.12	0.19	0.17	-0.08	0.46	1.00					
Portugal	1.81	0.07	0.39	0.03	0.50	0.58	0.27	0.54	0.48	0.20	-0.13	1.00				
Spain	1.20	0.04	0.51	0.23	0.41	0.69	0.38	0.53	0.37	0.22	-0.19	0.46	1.00			
Switzerland	1.92	0.24	0.65	0.39	0.41	0.67	0.47	0.68	0.31	0.46	0.06	0.58	0.54	1.00		
U.K.	1.60	0.34	0.24	0.35	0.31	0.53	0.28	0.36	0.34	0.23	0.09	0.18	0.44	0.31	1.00	
U.S.	1.58	0.35	0.23	0.72	-0.02	0.35	0.36	0.35	0.17	0.35	0.28	-0.22	0.25	0.37	0.58	1.00
OECD Total	1.04	0.42	0.50	0.68	0.15	0.62	0.67	0.61	0.50	0.59	0.20	0.11	0.46	0.55	0.70	0.87

Panel C: P-Values for testing Corr(C,C*) = Corr (Y,Y*)

	S.D. (%)	Australia	Austria	Canada	Finland	France	Germany	Italy	Japan	Netherlands	Norway	Portugal	Spain	Switzerland	U.K.	U.S.
Australia																
Austria		0.100														
Canada		0.013	0.636													
Finland		0.324	0.190	0.464												
France		0.308	0.000	0.428	0.519											
Germany		0.001	0.000	0.128	0.785	0.020										
Italy		0.179	0.000	0.118	0.762	0.002	0.037									
Japan		0.253	0.010	0.474	0.997	0.539	0.000	0.551								
Netherlands		0.113	0.004	0.272	0.496	0.270	0.706	0.210	0.388							
Norway		0.045	0.476	0.336	0.081	0.872	0.377	0.021	0.085	0.011						
Portugal		0.443	0.023	0.278	0.053	0.101	0.069	0.311	0.001	0.005	0.508					
Spain		0.861	0.105	0.868	0.857	0.009	0.156	0.947	0.642	0.782	0.568	0.496				
Switzerland		0.022	0.008	0.266	0.037	0.026	0.320	0.011	0.747	0.651	0.206	0.007	0.091			
U.K.		0.054	0.352	0.459	0.969	0.263	0.239	0.349	0.845	0.856	0.006	0.271	0.193	0.931		
U.S.		0.000	0.360	0.017	0.438	0.570	0.222	0.003	0.802	0.209	0.241	0.021	0.142	0.436	0.052	
OECD Total		0.001	0.018	0.035	0.795	0.418	0.052	0.007	0.809	0.334	0.158	0.023	0.298	0.504	0.229	0.376

Table 3:

Correlations of Consumption with Domestic and OECD Output

	First Differences			HP Filtered		
	Corr(C,Y)	Corr(C,W)	P-Values*	Corr(C,Y)	Corr(C,W)	P-Values*
Australia	0.32	0.18	0.119	0.59	0.13	0.000
Austria	0.60	0.04	0.000	0.58	0.24	0.001
Canada	0.55	0.33	0.012	0.81	0.55	0.000
Finland	0.47	0.17	0.022	0.76	0.20	0.000
France	0.48	0.37	0.191	0.65	0.46	0.028
Germany	0.67	0.42	0.005	0.76	0.46	0.000
Italy	0.59	0.48	0.150	0.81	0.49	0.000
Japan	0.77	0.45	0.000	0.77	0.53	0.000
Netherlands	0.14	0.18	0.599	0.61	0.51	0.224
Norway	0.43	0.13	0.008	0.50	-0.01	0.000
Portugal	0.39	-0.16	0.001	0.65	-0.32	0.000
Spain	0.75	0.37	0.000	0.81	0.44	0.000
Switzerland	0.61	0.33	0.006	0.78	0.60	0.009
U.K.	0.67	0.29	0.000	0.78	0.55	0.000
U.S.	0.68	0.61	0.165	0.88	0.75	0.001

* P-Values for testing Corr(C,Y) = Corr(C,W)

Table 4: PWT Data -- First Differenced

	Standard Deviation (%)		Cross Country Correlations (w/Rest-of-World)			Correlations with Ouput		
Country	Consumption	Output	Corr(C,C*)	Corr(Y,Y*)	P-Values	Corr(C,Y)	Corr(C,W)	P-Values
ARG	5.70	4.88	0.15	0.24	0.336	0.91	0.18	0.000
AUS	2.84	3.53	0.36	0.36	0.489	0.84	0.30	0.000
AUT	2.23	2.69	0.43	0.54	0.270	0.71	0.34	0.011
BEL	2.12	2.33	0.54	0.61	0.326	0.70	0.51	0.095
BGD	5.08	6.68	-0.04	0.18	0.211	0.71	-0.00	0.000
BOL	6.95	4.57	0.03	0.43	0.035	0.46	0.30	0.215
BRA	4.71	4.31	0.16	0.12	0.556	0.86	0.14	0.000
BRB	7.01	4.14	0.09	0.40	0.115	0.56	-0.03	0.008
BWA	13.48	8.48	-0.02	0.23	0.185	0.77	0.14	0.001
CAN	2.27	2.83	0.52	0.53	0.479	0.79	0.46	0.007
CHE	1.57	3.11	0.60	0.58	0.543	0.66	0.51	0.160
CHL	7.89	6.69	0.33	0.45	0.277	0.87	0.40	0.000
CIV	8.88	5.20	0.13	0.23	0.356	0.79	0.08	0.000
CMR	6.02	4.61	-0.09	-0.07	0.471	0.77	-0.14	0.000
COL	2.65	2.66	0.45	0.33	0.734	0.88	0.30	0.000
CRI	4.91	4.12	0.46	0.43	0.558	0.88	0.36	0.000
CYP	8.45	8.14	0.33	0.35	0.449	0.71	0.41	0.024
DEU	2.35	2.92	0.43	0.61	0.153	0.79	0.50	0.012
DNK	2.59	3.08	0.30	0.31	0.470	0.75	0.15	0.000
DOM	8.22	6.32	0.17	0.19	0.463	0.91	0.18	0.000
ECU	3.28	4.24	0.00	0.13	0.294	0.69	-0.10	0.000
ESP	3.64	4.14	0.17	0.33	0.233	0.90	0.34	0.000
FIN	3.78	3.53	0.31	0.32	0.481	0.59	0.33	0.075
FRA	1.74	1.98	0.44	0.62	0.136	0.77	0.53	0.035
GBR	3.65	2.51	0.15	0.43	0.092	0.81	0.18	0.000
GRC	3.06	3.59	0.05	0.45	0.029	0.55	-0.08	0.001
GTM	3.00	2.88	0.41	0.39	0.548	0.94	0.33	0.000
HKG	4.26	4.20	0.35	0.50	0.253	0.75	0.37	0.015
HND	3.58	3.13	0.47	0.52	0.400	0.76	0.38	0.005
HUN	3.57	3.51	0.01	0.01	0.501	0.69	0.10	0.015
IDN	4.14	4.06	-0.29	-0.62	0.943	0.64	-0.51	0.000
IND	4.37	4.06	-0.22	-0.30	0.650	0.79	-0.19	0.000
IRL	3.49	3.13	0.42	0.48	0.369	0.73	0.46	0.033
IRN	13.34	9.30	0.06	0.14	0.379	0.77	0.07	0.000
ISL	6.68	4.94	0.25	0.11	0.732	0.81	0.13	0.000
ISR	4.47	3.80	0.12	0.28	0.236	0.50	0.04	0.019
ITA	2.14	2.66	0.31	0.57	0.082	0.66	0.38	0.047
JAM	8.47	5.41	0.07	0.21	0.281	0.75	0.01	0.000
JPN	2.98	3.39	0.46	0.55	0.297	0.75	0.49	0.028
KEN	11.39	7.48	0.00	0.19	0.211	0.09	0.06	0.442
KOR	4.12	4.49	0.20	0.17	0.560	0.79	0.17	0.000
LKA	6.47	4.65	-0.15	-0.08	0.395	0.82	-0.04	0.000
LUX	1.64	4.56	0.41	0.13	0.910	-0.04	0.51	0.995
MAR	6.00	5.18	0.02	-0.04	0.586	0.90	0.09	0.000
MEX	3.96	4.00	0.04	0.23	0.195	0.96	0.27	0.000
MLT	4.68	4.23	0.10	-0.15	0.836	0.71	0.12	0.001
MYS	5.78	5.18	0.00	0.19	0.231	0.89	0.17	0.000
NLD	2.38	2.89	0.56	0.58	0.460	0.70	0.41	0.030
NOR	2.96	1.87	0.22	0.19	0.549	0.66	0.12	0.002
NZL	4.92	3.93	0.31	0.21	0.673	0.72	0.37	0.015
PAK	6.52	4.18	-0.16	0.08	0.149	0.81	0.00	0.000
PAN	6.18	5.62	-0.12	-0.10	0.460	0.54	-0.06	0.002
PER	5.52	5.91	0.27	0.18	0.653	0.74	0.18	0.000
PHL	3.30	3.59	0.10	-0.01	0.683	0.76	0.16	0.000
POL	7.19	7.83	0.53	0.41	0.676	0.78	0.42	0.038
PRT	5.32	3.71	0.08	0.47	0.034	0.71	0.24	0.003
PRY	8.25	5.00	-0.04	-0.00	0.444	0.87	0.02	0.000
SEN	5.55	4.29	-0.00	-0.28	0.851	0.88	-0.09	0.000
SGP	4.01	4.29	0.00	0.10	0.360	0.81	-0.03	0.000
SLV	4.81	3.81	0.53	0.47	0.648	0.95	0.51	0.000
SWE	1.70	1.76	0.40	0.28	0.726	0.59	0.27	0.038
SYR	15.62	11.27	0.02	-0.05	0.592	0.93	-0.00	0.000
THA	5.32	4.88	-0.03	-0.00	0.447	0.91	-0.08	0.000
TTO	10.24	7.26	0.05	0.09	0.431	0.95	0.03	0.000
TUN	5.66	3.53	0.03	0.01	0.527	0.84	-0.06	0.000
TUR	6.65	5.51	-0.01	0.03	0.431	0.92	0.14	0.000
TZA	7.56	5.94	0.28	0.30	0.477	0.59	0.26	0.076
URY	6.75	5.89	0.16	0.27	0.316	0.91	0.31	0.000
USA	1.81	2.73	0.37	0.36	0.514	0.80	0.65	0.079
VEN	6.91	4.77	0.14	0.31	0.224	0.60	0.15	0.010
YUG	10.70	6.43	0.06	0.20	0.302	0.65	0.07	0.004
ZAF	5.16	3.47	0.07	0.24	0.232	0.85	0.20	0.000
ZWE	6.41	4.89	-0.03	-0.18	0.729	0.71	-0.17	0.000
Averages	5.36	4.53	0.18	0.23	0.411	0.75	0.19	0.000

Table 5: PWT Data -- HP Filtered

	Standard Deviation (%)		Cross Country Correlations (w/Rest-of-World)			Correlations with Ouput		
Country	Consumption	Output	Corr(C,C*)	Corr(Y,Y*)	P-Values	Corr(C,Y)	Corr(C,W)	P-Values
ARG	4.74	4.05	0.33	0.30	0.552	0.89	0.27	0.000
AUS	2.51	3.06	0.56	0.49	0.646	0.89	0.47	0.000
AUT	2.03	2.37	0.09	0.34	0.124	0.74	-0.01	0.000
BEL	2.67	2.92	0.72	0.78	0.259	0.82	0.59	0.020
BGD	5.45	7.41	-0.03	0.09	0.323	0.64	-0.05	0.001
BOL	6.19	5.05	-0.05	0.55	0.002	0.38	0.13	0.124
BRA	5.86	6.11	0.10	0.05	0.581	0.92	0.01	0.000
BRB	6.67	4.75	0.43	0.67	0.100	0.69	0.32	0.030
BWA	12.50	8.70	0.23	0.29	0.407	0.78	0.29	0.003
CAN	2.88	3.04	0.69	0.66	0.587	0.83	0.55	0.007
CHE	1.94	3.29	0.58	0.55	0.578	0.79	0.61	0.058
CHL	9.50	7.56	0.32	0.52	0.147	0.95	0.45	0.000
CIV	6.88	4.24	-0.09	-0.05	0.444	0.75	-0.18	0.000
CMR	6.37	6.33	-0.16	-0.43	0.866	0.82	-0.20	0.000
COL	2.68	3.07	0.61	0.42	0.867	0.91	0.47	0.000
CRI	5.75	4.90	0.56	0.54	0.539	0.93	0.49	0.000
CYP	9.59	8.44	0.39	0.42	0.431	0.68	0.52	0.139
DEU	2.51	2.75	0.31	0.32	0.478	0.85	0.29	0.000
DNK	2.92	3.28	0.23	0.36	0.269	0.85	0.29	0.000
DOM	6.02	5.60	0.18	0.10	0.645	0.91	0.11	0.000
ECU	4.52	5.96	0.01	0.02	0.486	0.84	-0.09	0.000
ESP	4.23	4.85	0.55	0.64	0.271	0.96	0.66	0.000
FIN	3.82	3.53	0.49	0.41	0.669	0.69	0.56	0.169
FRA	1.94	2.20	0.63	0.77	0.100	0.80	0.68	0.116
GBR	3.38	2.48	0.28	0.59	0.044	0.82	0.34	0.000
GRC	3.10	3.71	0.50	0.66	0.141	0.74	0.34	0.005
GTM	4.24	4.19	0.41	0.30	0.707	0.97	0.32	0.000
HKG	4.01	3.96	0.14	0.29	0.270	0.78	0.18	0.001
HND	3.88	3.81	0.40	0.42	0.455	0.88	0.31	0.000
HUN	3.34	3.93	-0.07	-0.09	0.523	0.75	-0.14	0.000
IDN	5.12	5.61	-0.76	-0.54	0.079	0.78	-0.75	0.000
IND	3.32	3.64	-0.16	-0.21	0.580	0.68	-0.08	0.000
IRL	3.61	3.63	0.59	0.61	0.427	0.81	0.61	0.033
IRN	12.83	10.89	0.08	0.09	0.489	0.86	-0.01	0.000
ISL	5.96	5.03	0.37	0.10	0.891	0.86	0.22	0.000
ISR	3.17	4.10	0.13	0.36	0.149	0.29	0.15	0.266
ITA	2.70	2.31	0.48	0.52	0.405	0.63	0.62	0.466
JAM	6.61	6.21	0.35	0.38	0.435	0.77	0.22	0.000
JPN	2.77	4.22	0.46	0.56	0.276	0.76	0.61	0.103
KEN	8.42	6.17	0.33	0.42	0.334	0.89	0.32	0.000
KOR	5.06	5.75	0.61	0.49	0.758	0.89	0.40	0.000
LKA	4.88	4.16	-0.53	-0.44	0.306	0.86	-0.47	0.000
LUX	1.86	4.73	0.52	0.26	0.912	0.27	0.47	0.851
MAR	7.69	6.79	-0.02	0.12	0.273	0.96	0.20	0.000
MEX	4.26	4.43	0.09	0.05	0.556	0.97	0.19	0.000
MLT	5.94	5.62	0.55	0.09	0.984	0.69	0.44	0.060
MYS	7.16	6.30	-0.07	-0.03	0.428	0.95	-0.03	0.000
NLD	2.83	3.07	0.73	0.71	0.567	0.81	0.64	0.049
NOR	3.30	2.26	-0.02	0.08	0.331	0.77	-0.05	0.000
NZL	4.33	3.90	0.23	0.13	0.671	0.84	0.30	0.000
PAK	7.38	5.85	-0.01	0.20	0.172	0.93	0.19	0.000
PAN	5.35	5.70	-0.24	-0.12	0.290	0.60	-0.21	0.000
PER	5.19	5.30	0.33	0.11	0.848	0.69	0.31	0.011
PHL	3.93	4.96	0.15	-0.06	0.822	0.85	0.13	0.000
POL	8.16	11.77	0.34	0.30	0.565	0.76	0.27	0.016
PRT	7.26	5.07	0.53	0.63	0.257	0.85	0.49	0.001
PRY	6.63	5.68	-0.18	-0.14	0.433	0.84	-0.23	0.000
SEN	4.30	3.07	-0.19	-0.34	0.727	0.85	-0.17	0.000
SGP	6.98	6.41	0.24	0.00	0.814	0.93	0.11	0.000
SLV	6.72	5.32	0.53	0.51	0.556	0.98	0.53	0.000
SWE	1.94	1.95	0.56	0.44	0.753	0.69	0.56	0.168
SYR	11.83	9.40	0.23	-0.16	0.930	0.86	0.14	0.000
THA	5.55	5.65	0.20	0.29	0.344	0.94	0.26	0.000
TTO	9.81	7.90	-0.24	-0.26	0.546	0.96	-0.27	0.000
TUN	8.07	4.97	-0.07	-0.17	0.651	0.95	-0.20	0.000
TUR	6.26	5.59	0.25	0.11	0.742	0.93	0.26	0.000
TZA	6.47	5.79	0.45	0.56	0.299	0.80	0.43	0.011
URY	6.34	6.67	0.36	0.28	0.645	0.85	0.38	0.000
USA	2.06	2.88	0.59	0.51	0.698	0.86	0.78	0.145
VEN	8.49	4.78	-0.04	0.22	0.125	0.67	-0.18	0.000
YUG	8.93	5.86	0.26	-0.03	0.863	0.64	0.17	0.013
ZAF	5.11	3.58	0.31	0.25	0.604	0.88	0.24	0.000
ZWE	6.27	6.06	0.22	0.04	0.780	0.80	0.04	0.000
Averages	5.38	4.99	0.24	0.25	0.498	0.90	0.90	0.500

Table 6:

Correlations for a Calibrated Nontraded Goods Model

$1/\gamma$	$1/\delta$	Corr(C,C*)	Corr(Y,Y*)	Corr(C,Y)	Corr(C,W)
1.00	10.00	.997	.640	.916	.999
1.00	4.00	.987	.640	.927	.997
1.00	2.00	.965	.640	.938	.991
1.00	1.00	.923	.640	.949	.981
1.00	0.50	.866	.640	.954	.966
1.00	0.25	.813	.640	.956	.952
1.00	0.10	.765	.640	.956	.939
10.00	0.44	.743	.640	.956	.933
4.00	0.44	.769	.640	.956	.940
2.00	0.44	.805	.640	.957	.950
1.00	0.44	.856	.640	.955	.963
0.50	0.44	.913	.640	.950	.978
0.25	0.44	.959	.640	.941	.990
0.10	0.44	.989	.640	.926	.997

Figure 1:

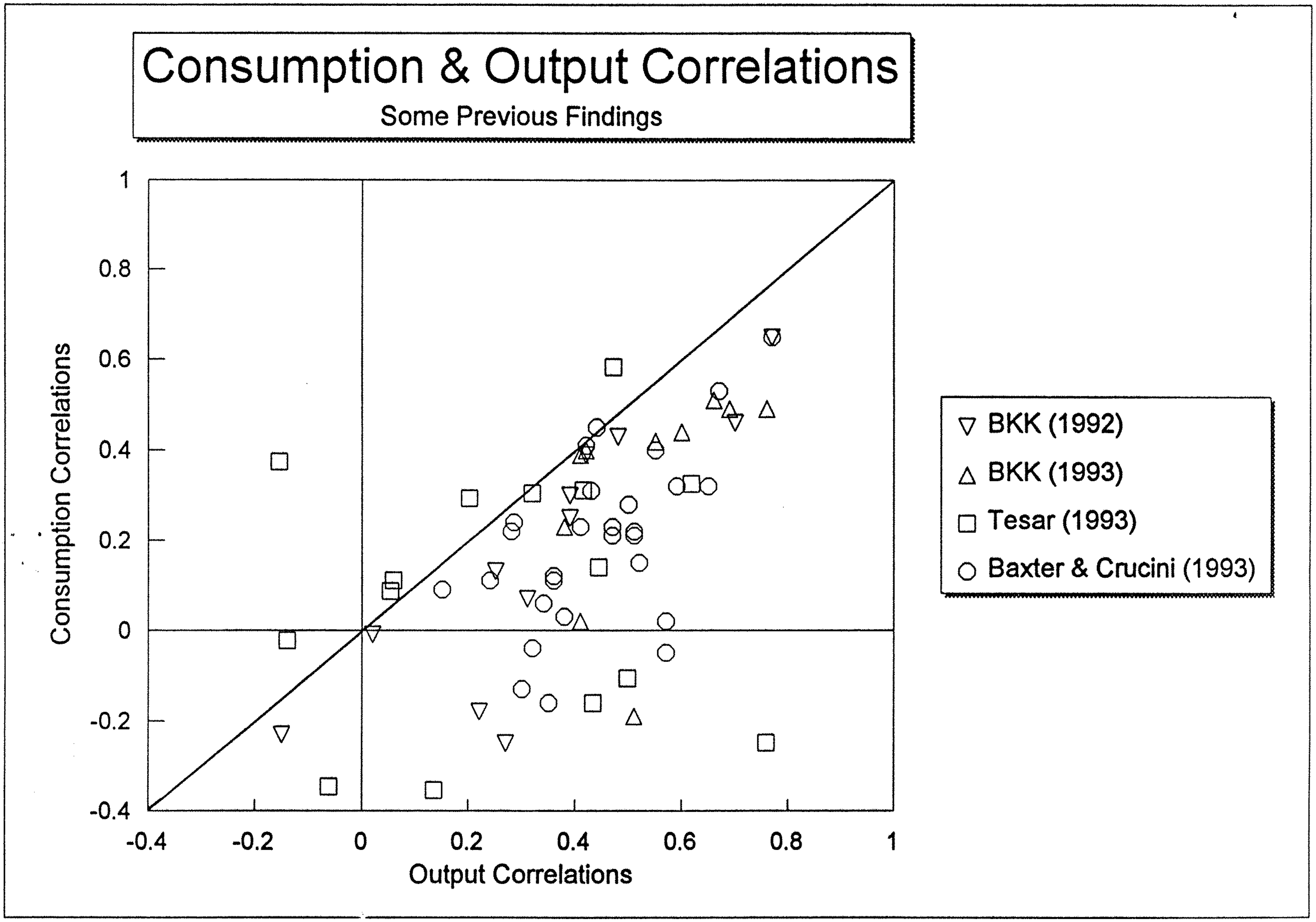
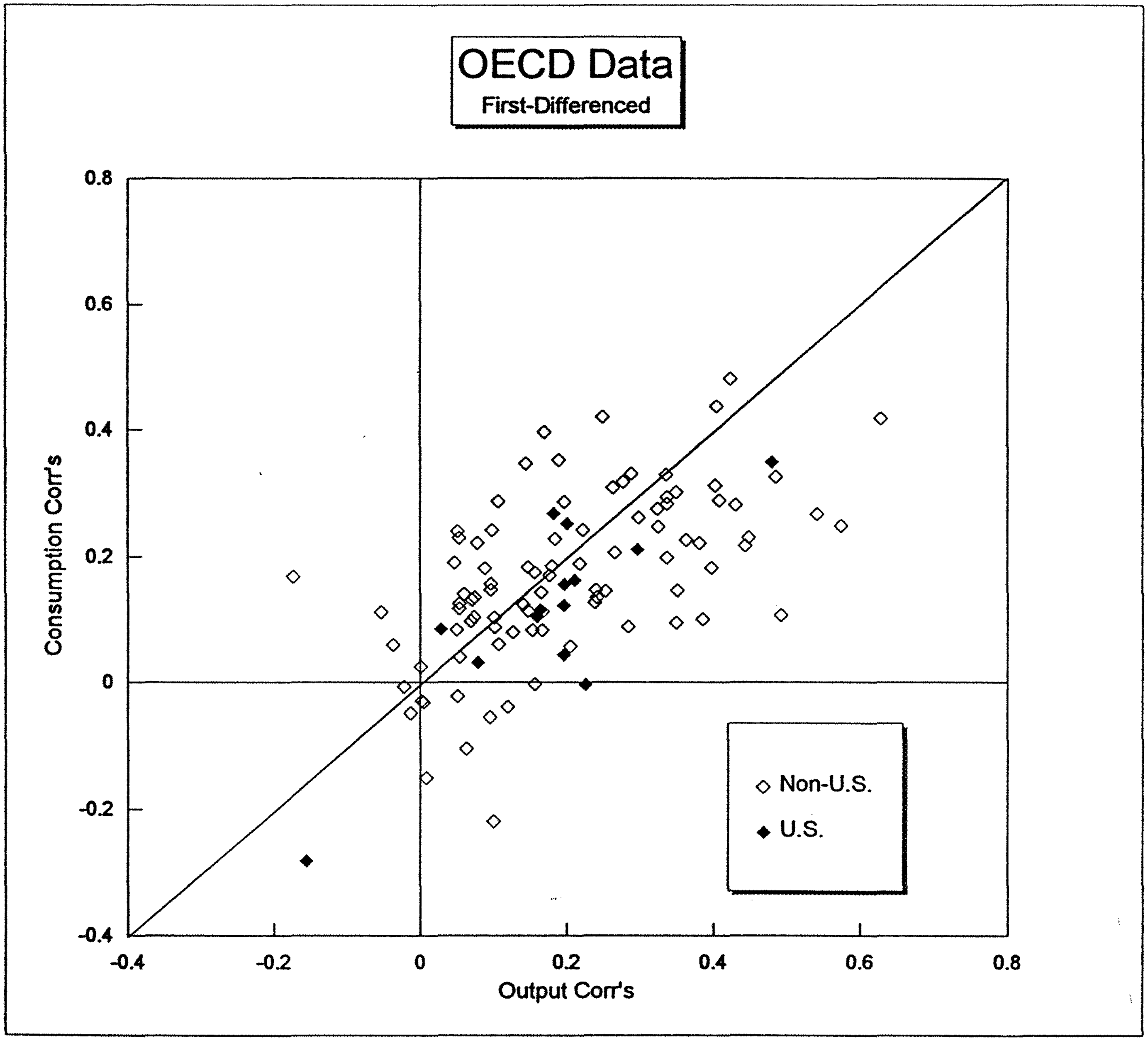
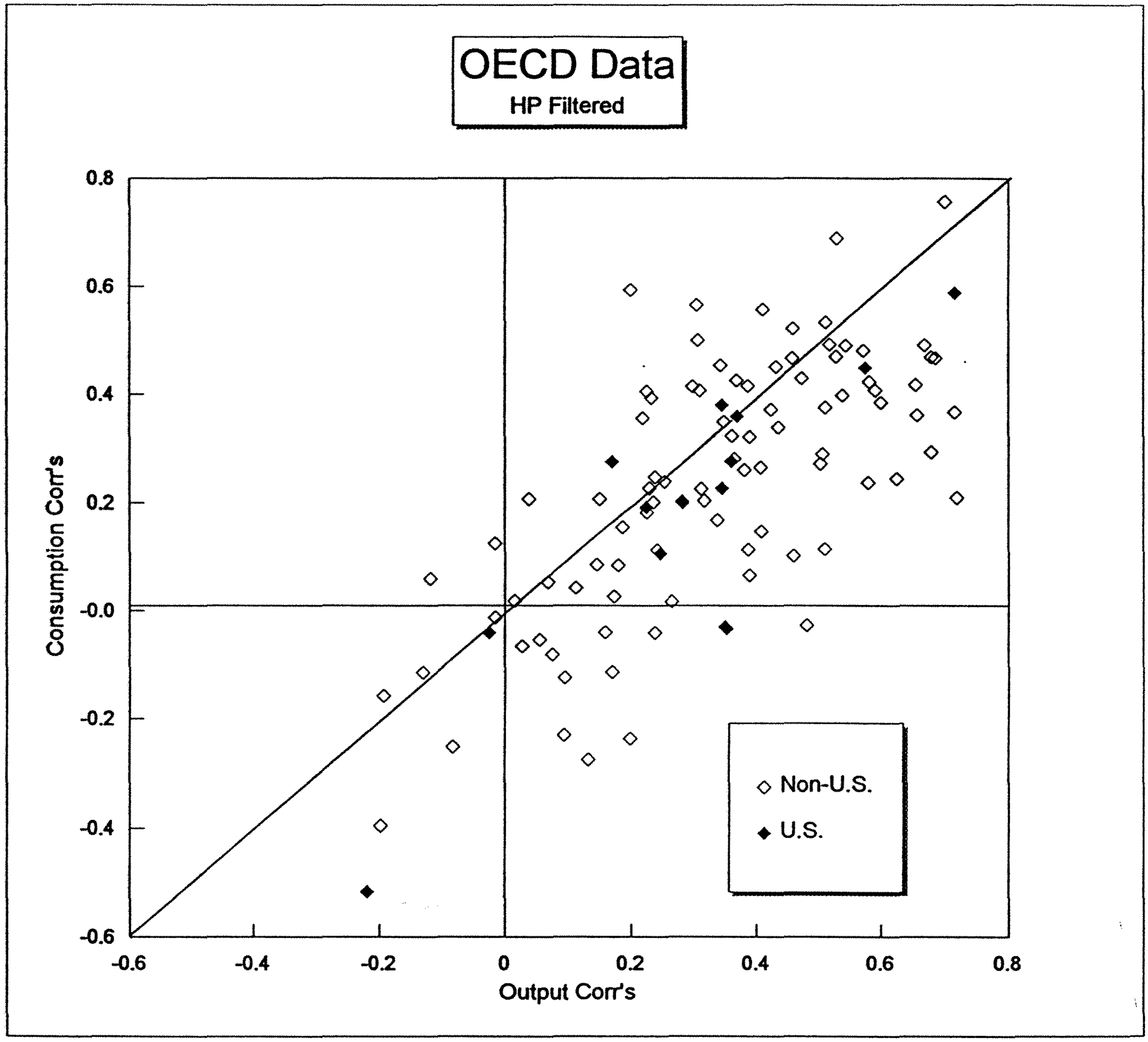

Consumption & Output Correlations
Some Previous Findings
Consumption Correlations
Output Correlations
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
BKK (1992)
BKK (1993)
Tesar (1993)
Baxter & Crucini (1993)

Figure 2:



OECD Data
First-Differenced
Consumption Corr's
Output Corr's
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8
Non-U.S.
U.S.

Figure 3:



OECD Data
HP Filtered
0.8
0.6
0.4
0.2
-0.0
-0.2
-0.4
-0.6
Consumption Corr's
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
Output Corr's
Non-U.S.
U.S.

Figure 4:

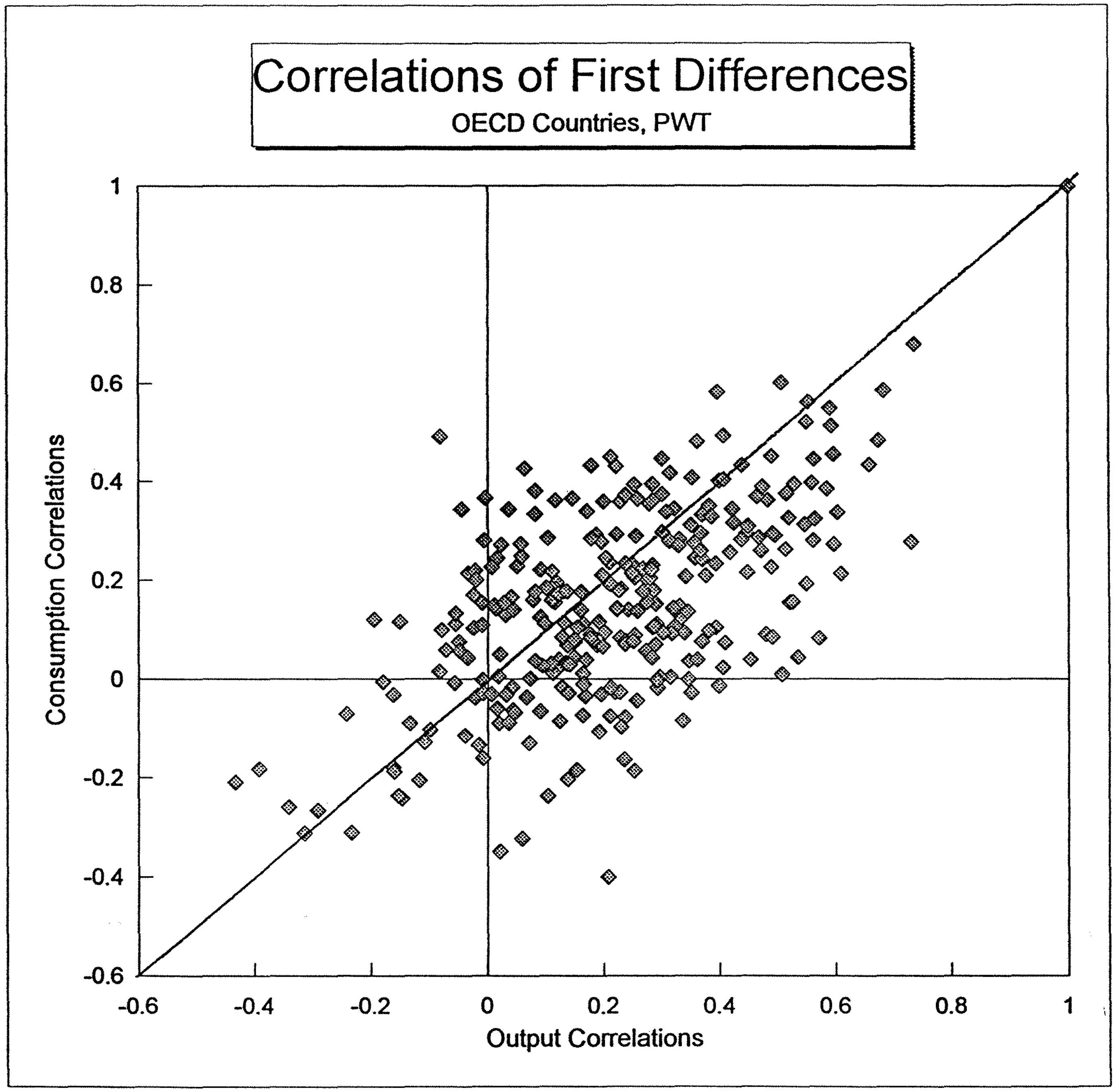

Correlations of First Differences
OECD Countries, PWT
Consumption Correlations
Output Correlations
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

Figure 5:

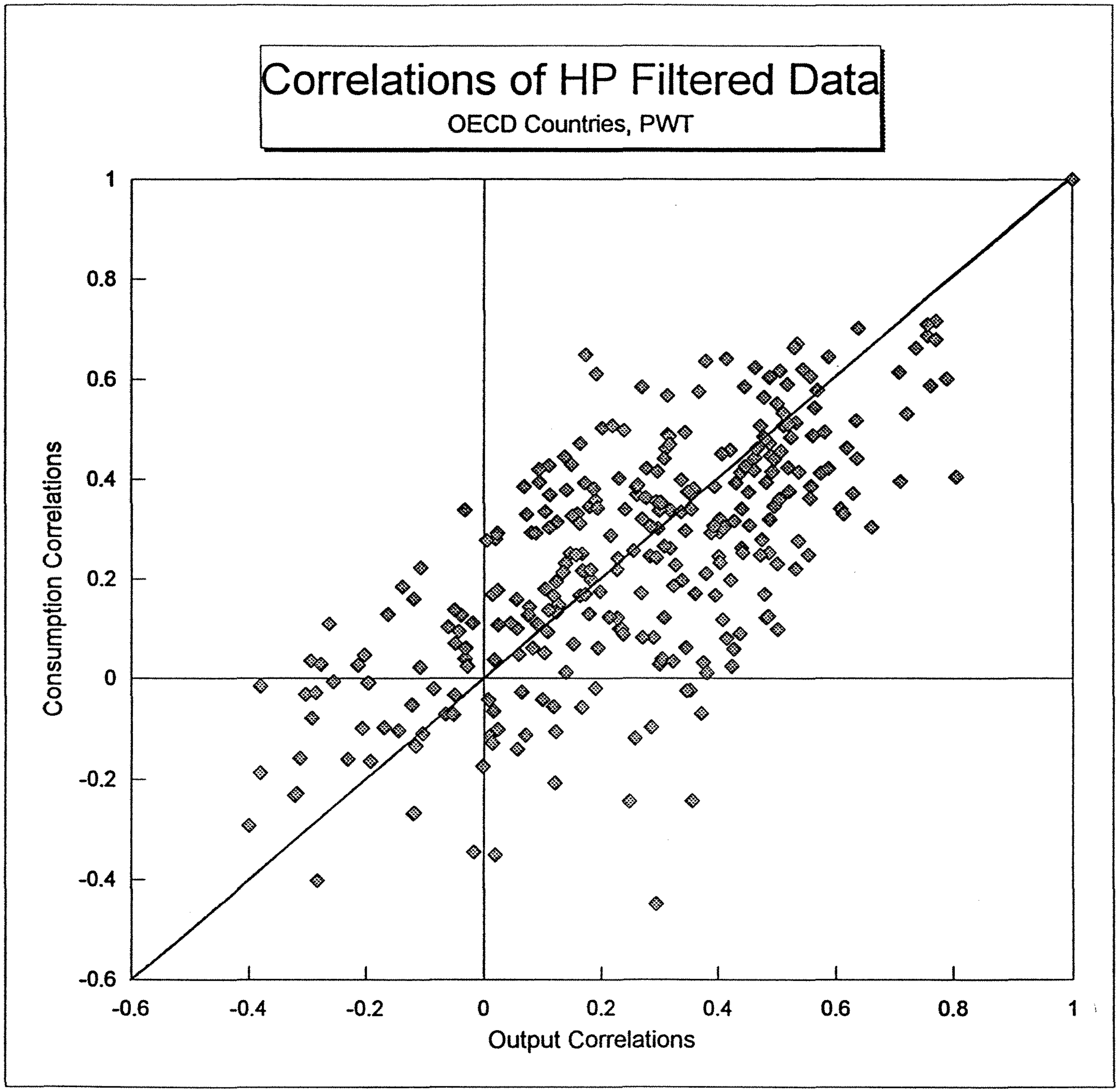
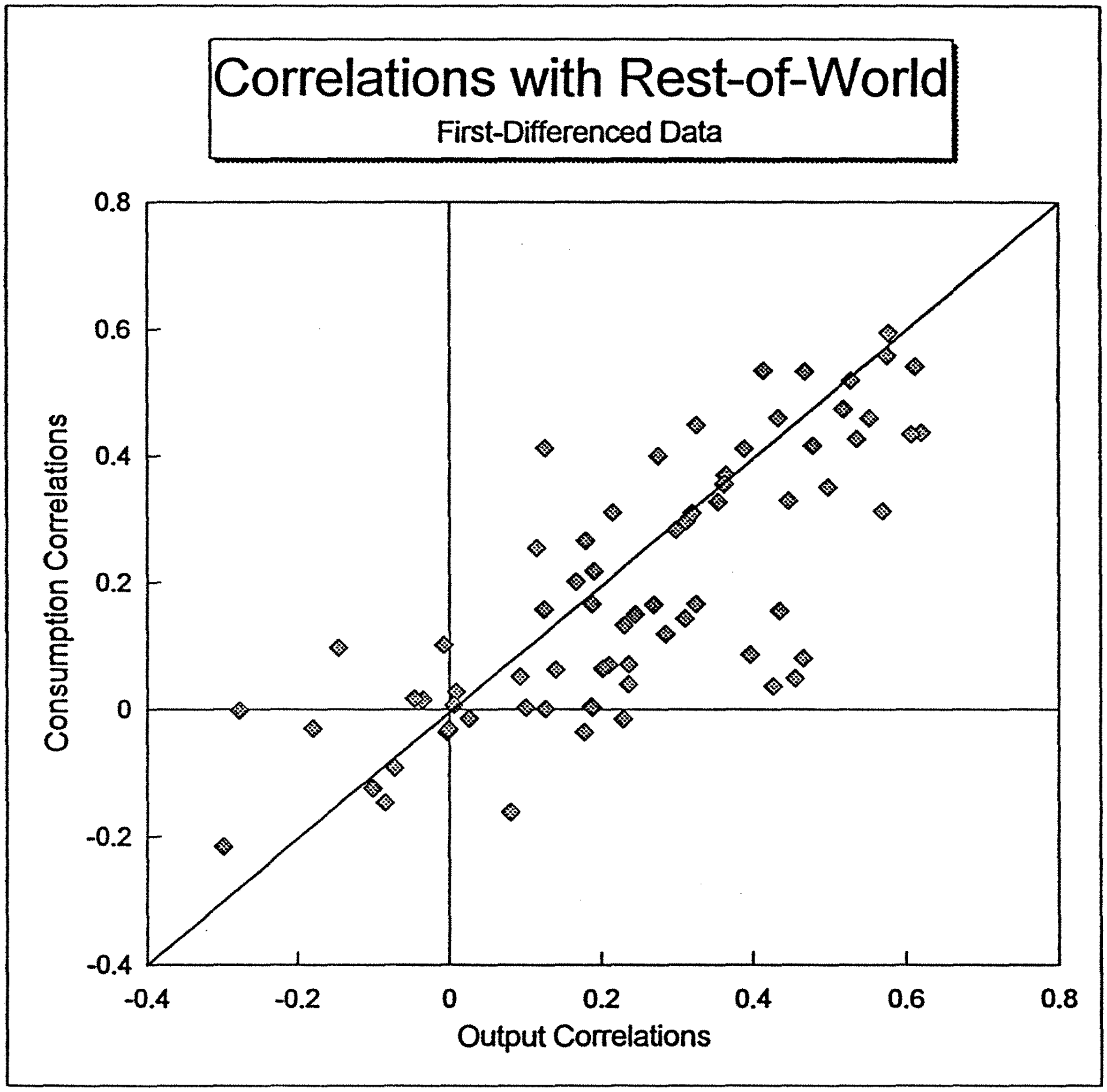

Correlations of HP Filtered Data
OECD Countries, PWT
Consumption Correlations
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Output Correlations

Figure 6:



Correlations with Rest-of-World
First-Differenced Data
0.8
0.6
0.4
0.2
0
-0.2
-0.4
Consumption Correlations
-0.4
-0.2
0
0.2
0.4
0.6
0.8
Output Correlations

Figure 7:

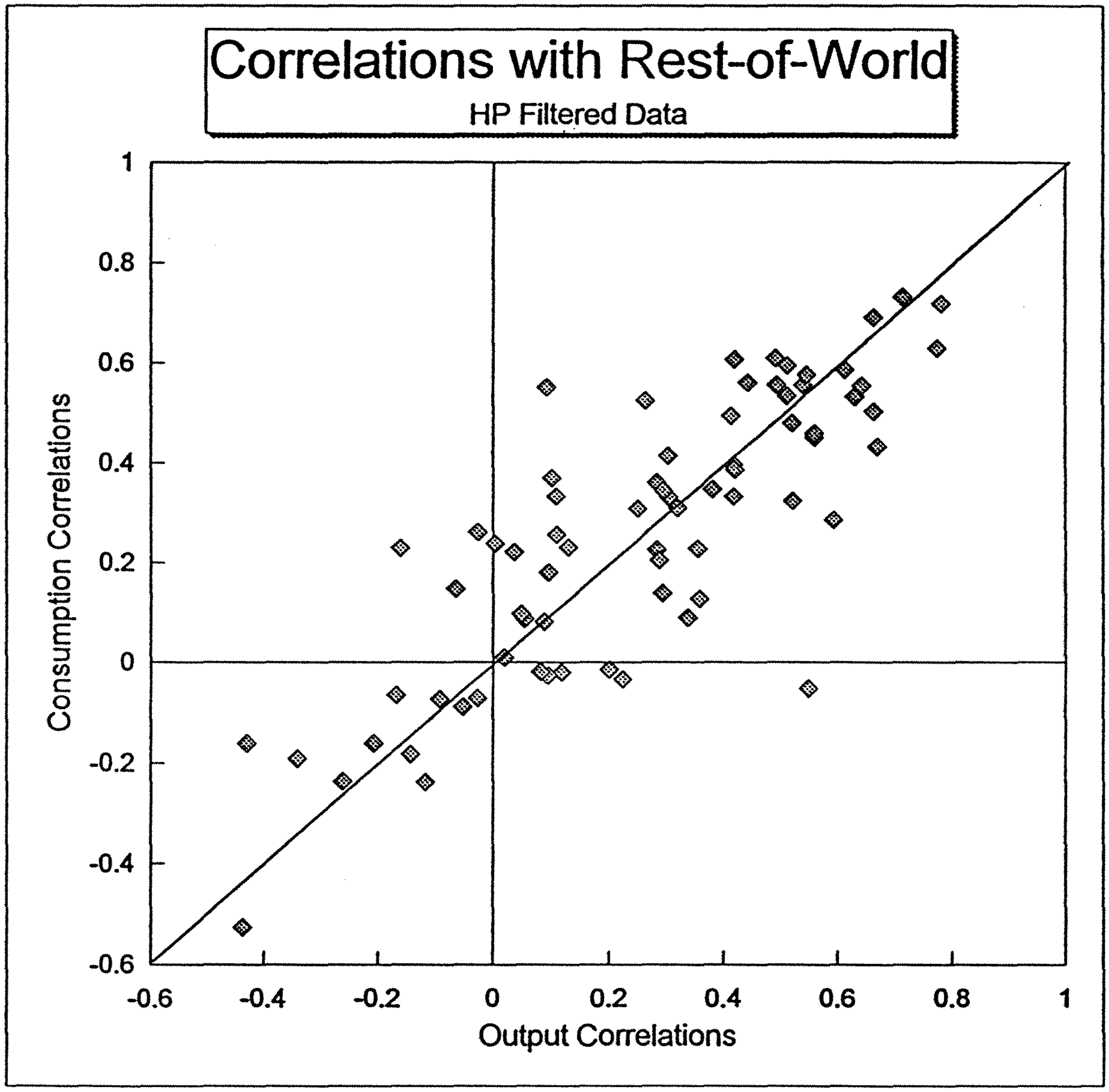
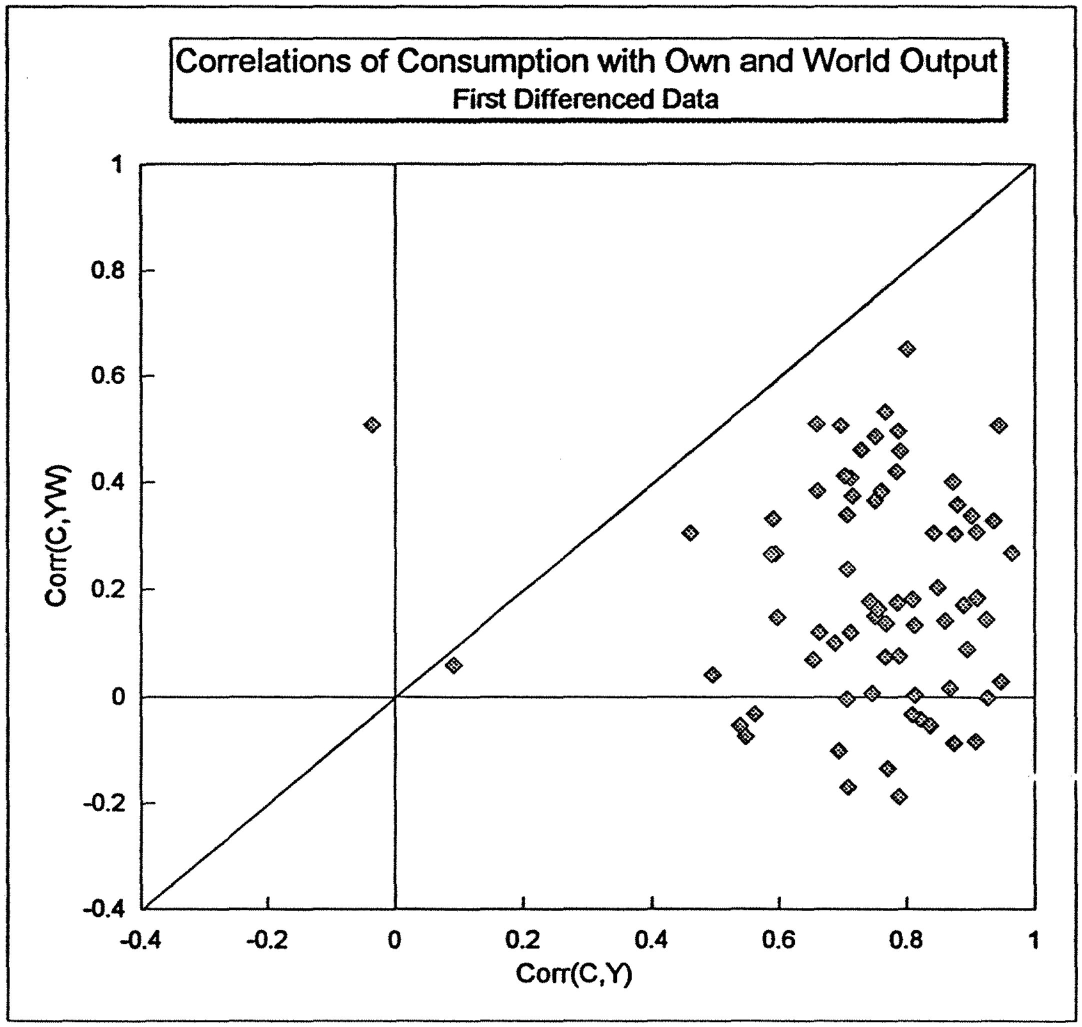

Correlations with Rest-of-World
HP Filtered Data
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
Consumption Correlations
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Output Correlations

Figure 8:



Correlations of Consumption with Own and World Output
First Differenced Data
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
Corr(C,YW)
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Corr(C,Y)

Figure 9:

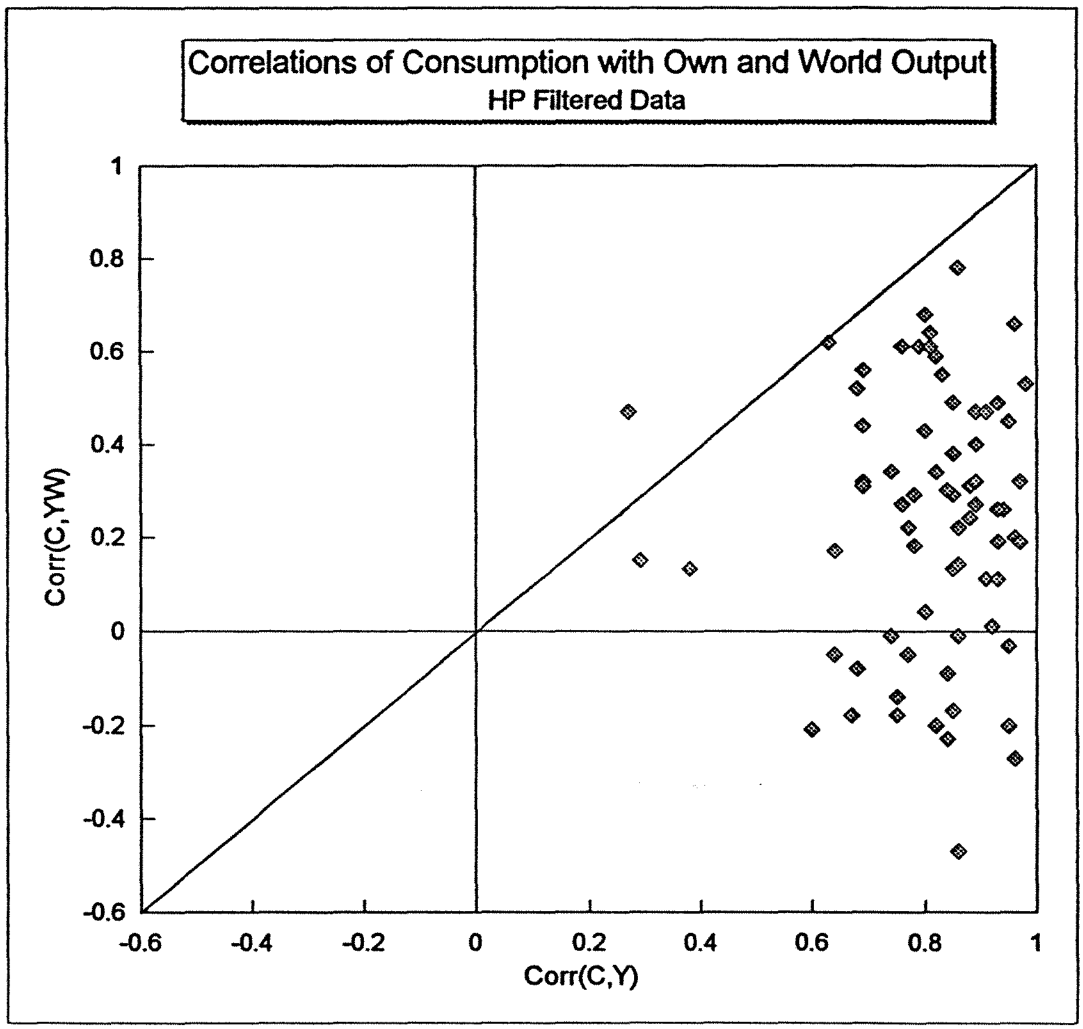
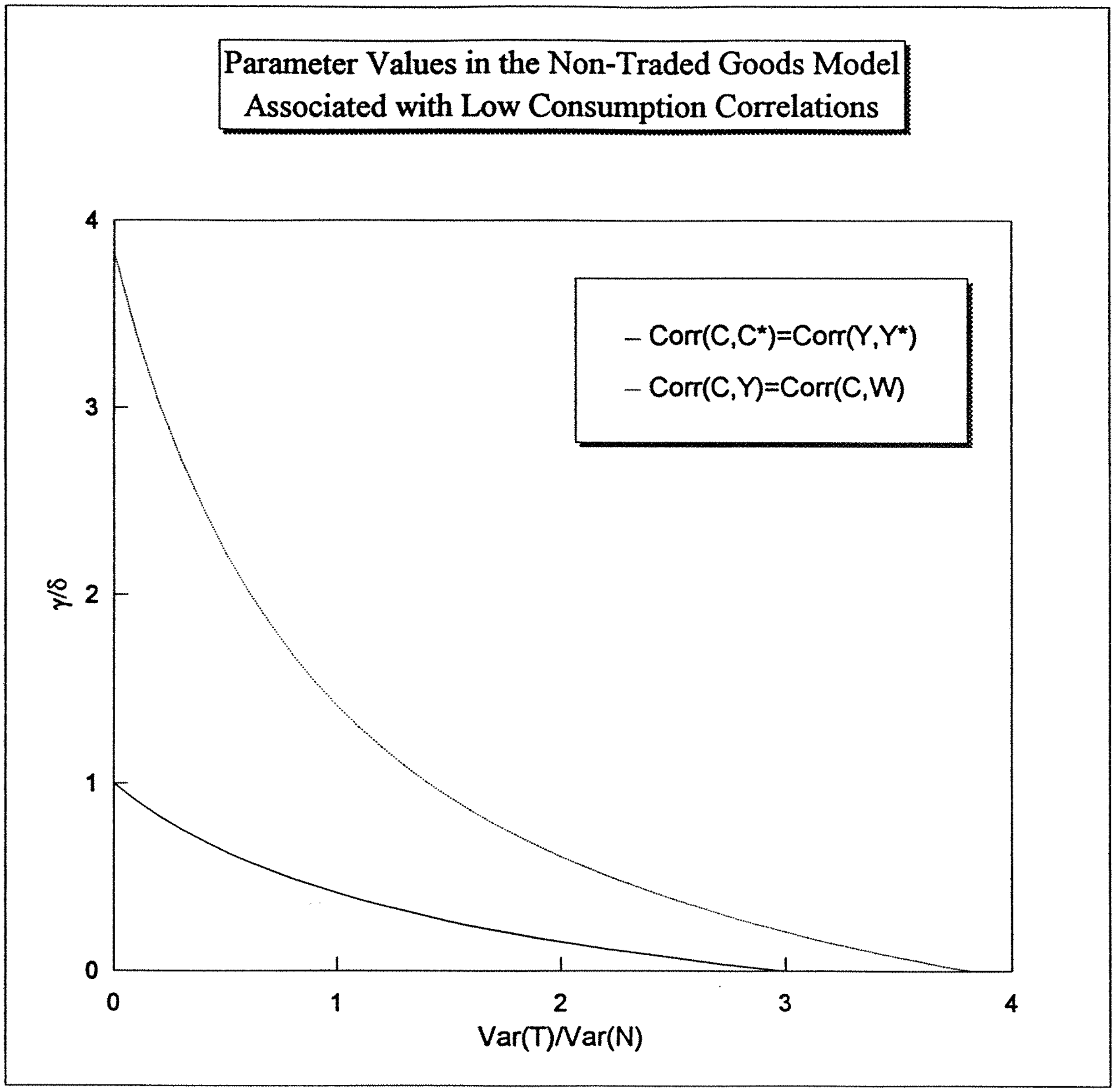

Correlations of Consumption with Own and World Output
HP Filtered Data
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
Corr(C,YW)
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Corr(C,Y)

Figure 10:



NOTE: Combinations of parameter values corresponding to points lying below the curves correspond to Corr(C,C*) < Corr(Y,Y*) and Corr(C,Y) > Corr(C,W).